BAYOU DES CANNES TMDL FOR NUTRIENTS

SUBSEGMENT 050101

US EPA Region 6

Final

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EXECUTIVE SUMMARY

Section 303(d) of the Federal Clean Water Act requires states to identify waterbodies that are not meeting water quality standards and to develop total maximum daily pollutant loads for those waterbodies. A total maximum daily load (TMDL) is the amount of a pollutant that a waterbody can assimilate without exceeding the established water quality standard for that pollutant. Through a TMDL, pollutant loads can be distributed or allocated to point sources and nonpoint sources discharging to the waterbody. A TMDL has been developed for nutrients for Bayou Des Cannes.

Bayou Des Cannes flows from its headwaters into the Mermentau River. Bayou Des Cannes segment 050101 was listed on the October 28, 1999 Court Ordered §303(d) lists as not fully supporting the water quality standard for propagation of fish and wildlife and was ranked as a high priority for TMDL development. In the State of Louisiana Surface Water Quality Standards, the general criterion for nutrients states "The naturally occurring range of nitrogen-phosphorus ratios shall be maintained…. Nutrient concentrations that produce aquatic growth to the extent that it creates a public nuisance or interferes with designated water uses shall not be added to any surface waters." In addition, LDEQ issued a declaratory ruling on April 29, 1996, concerning this language and stated, "That DO directly correlates with overall nutrient impact is a well-established biological and ecological principle. Thus, when the LDEQ maintains and protects DO, the LDEQ is in effect also limiting and controlling nutrient concentrations and impacts." In this TMDL, the nutrient loading required to maintain dissolved oxygen standards will be the nutrient TMDL. Based on the recently completed Use Attainability Analysis (UAA) for the Mermentau River Basin, the applicable DO criteria for this subsegment are 3.0 mg/L for the summer months March through November and 5.0 mg/L for the winter months December through February.

EPA has identified nutrient ratios using twenty years of historical values in the State of Louisiana's database, and ranges of ratios found in scientific literature indicating nitrogen or phosphorus limitation. The literature generally indicates that where the nitrogen to phosphorus ratio is less than ten, a water body system is considered to be nitrogen limited. Review of historical State data for Bayou Des Cannes indicates that 56 out of 57 assessed sampling events displayed nitrogen limitation ratios and that phosphorus was not in excess (Appendix A). Since 98% of the sampling events confirmed nitrogen limiting conditions, it has been determined that a nitrogen TMDL for Bayou Des Cannes is warranted. A TMDL for phosphorus is not necessary because controls on nitrogen will maintain naturally occurring nitrogen-phosphorus ratios. Therefore, the nitrogen loading required to maintain the dissolved oxygen standard will constitute the nutrient TMDL.

The nutrient TMDL includes one point source discharger, wasteload allocation, load allocation, and margin of safety. As presented in LDEQ (1999), the summer season DO criterion of 3.0 mg/L can be maintained with a 50% reduction of all manmade nonpoint sources for reaches 1-6, 75% reduction of all manmade nonpoint sources for reaches 7-8 and implementation of the wasteload allocation (WLA) for the single point source discharger as presented in Table 2 of this report. For the winter season, the DO criterion of 5.0 mg/L can be maintained with a 50%

reduction from all manmade nonpoint sources for reaches 1-6, 75% reduction for reaches 7-8 and implementation of the WLA for the single point source discharger as presented in Table 2.

1. Introduction

Bayou Des Cannes segment 050101 was listed on the October 28, 1999 Court Ordered §303(d) list as not fully supporting the water quality standard for propagation of fish and wildlife. A TMDL for nutrients was developed in accordance with the requirements of Section 303 of the federal Clean Water Act. The purpose of a TMDL is to determine the pollutant loading that a waterbody can assimilate without exceeding the water quality standard for that pollutant; the TMDL also establishes the load reduction that is necessary to meet the standard in a waterbody. The TMDL consists of the wasteload allocation (WLA), the load allocation (LA), and a margin of safety (MOS). The wasteload allocation is the load allocated to point sources of the pollutant of concern, and the load allocation is the load allocated to nonpoint sources. The margin of safety is a percentage of the TMDL that accounts for the uncertainty associated with the model assumptions and data inadequacies.

2. Study Area Description

2.1. Bayou Des Cannes, Subsegment 050101

Water quality segment 0501 is part of the Mermentau River Basin. The Basin encompasses the prairie region of the state and a section of the coastal zone. Bayou Des Cannes is located in southwestern Louisiana in the Mermentau River Basin. The Mermentau River Basin is bounded on the north and east by the Vermilion-Teche Basin, on the west by the Calcasieu Basin and southward by the Gulf of Mexico. Land resources of the Mermentau River Basin consist of low relief prairie land interspersed with trees that line stream banks and some wetland areas. Natural vegetation in this region is comprised of bluestem, broomsedge, water grass, and switch grass. Vegetation introduced to the vicinity includes Johnson grass and carpet grass. The well-developed soil profile consists of dark to gray topsoil with an impervious claypan located approximately 14 inches below the surface. This claypan is conducive to rice farming because it holds water necessary for irrigation of crops. Soybeans and crawfish are rotated with rice crops. The average annual rainfall in the vicinity of Bayou des Cannes is approximately 57 inches. The area is sparsely populated outside its small municipalities and land use is dominated by agriculture. The land use for Bayou des Cannes watershed is summarized in Table 1. See LDEQ (1999) for additional discussion of the study area.

Table 1. Land Uses in Segment 0501

LAND USE TYPE	NUMBER OF ACRES	% OF TOTAL AREA
Urban	4,092	2.55
Barren Land	86	0.05
Agricultural	121,401	75.75
Forest Land	18,853	11.76
Water	3,209	2.00
Wetland	9,055	5.65
Rangeland	3,561	2.22
Other	32	.02
TOTAL AREA	160,257	100

2.2 Water Quality Standards

The designated uses for Bayou Des Cannes include the propagation of fish and wildlife. In the State of Louisiana Surface Water Quality Standards, the general criterion for nutrients states: "The naturally occurring range of nitrogen-phosphorus ratios shall be maintained.... Nutrient concentrations that produce aquatic growth to the extent that it creates a public nuisance or interferes with designated water uses shall not be added to any surface waters." In addition, LDEQ issued a declaratory ruling on April 29, 1996, concerning this language and stated, "That DO directly correlates with overall nutrient impact is a well-established biological and ecological principle. Thus, when the LDEQ maintains and protects DO, the LDEQ is in effect also limiting and controlling nutrient concentrations and impacts." DO serves as the indicator for the water quality criteria and for assessment of use support. In this TMDL, the nutrient loading required to maintain the dissolved oxygen standard is the nutrient TMDL.

EPA has identified nutrient ratios using historical values in the State of Louisiana's database, and ranges of ratios found in scientific literature indicating nitrogen or phosphorus limitation. Based upon the literature, nitrogen to phosphorus ratios of less than ten are generally indicative of a nitrogen limited water body system (Wetzel 1975, Day 1989, Allan 1995). The eight-year average for nitrogen to phosphorus ratio (January 1991 through December 1998) is 5.61 (Appendix A). Review of historical State data for Bayou Des Cannes also indicates that 56 out of 57 assessed sampling events displayed nitrogen limitation ratios and that phosphorus was not in excess. Since 98% of the sampling events confirmed nitrogen-limiting conditions, it is determined that a nitrogen TMDL for Bayou Des Cannes is warranted. A TMDL for phosphorus is not necessary because controls on nitrogen will maintain naturally occurring nitrogen-phosphorus ratios. Therefore, the nitrogen loading required to maintain the dissolved oxygen standard will constitute the nutrient TMDL. The applicable dissolved oxygen criteria are as follows:

Season	Temperature (^{o}C)	DO(mg/L)
Summer (March-November)	32	3.0
Winter (December-February)	32	5.0

2.3 Identification of Sources

The sources identified in the *1998 Louisiana Water Quality Inventory* as affecting the water quality of Bayou Des Cannes are unknown sources (LDEQ 1998). Suspected sources identified in the State's 1993 Nonpoint Source §319 Report include municipal sources, irrigated/non-irrigated crop production, and petroleum activities (LDEQ 1993).

2.3.1 Point Sources

There is one permitted facility with known flow information discharging sanitary wastewater into Bayou Des Cannes and its tributaries (see Table 2). Nutrient contribution from the point source dischargers will be controlled through NPDES permit limits for NH_3-N, which is representative of total nitrogen.

2.3.2 Nonpoint Sources

The predominant land uses in the Bayou Des Cannes watershed are agriculture and forestry, both of which can contribute to nutrient loads through runoff.

3. TMDL Load Calculations

LDEQ submitted a DO model for Bayou Des Cannes subsegment 050101 in November 1999 (LDEQ 1999). The model was reviewed and approved by EPA. This model was used to address nutrient listing for this segment. Table 7 in the DO TMDL modeling report included a WLA, LAs, and an MOS for one point source discharger (LDEQ 1999). The individual discharger WLA was recalculated based on $CBOD_5$ and NH_3-N concentrations as listed in LDEQ's 1999 summer and winter TMDL calculations for Bayou Des Cannes (LDEQ 1999). Tables 2 and 3 present the WLA, LAs, and MOS for this nutrient TMDL.

3.1 Loading Capacity and TMDL Formulation

According to LDEQ (1999), input data for the calibration model was developed from the LDEQ Reference Stream Study, data collected during the 1999 intensive survey, data collected by LDEQ and USGS at several ambient monitoring stations in the watershed, DMRs, permits and permit applications, USGS drainage area and low flow publications, and data garnered from several previous LDEQ studies on nonpoint source loadings. A satisfactory calibration was achieved for the main stem and on the tributaries modeled. For the projection models, data was taken from the current municipal discharge permits, current applications, and ambient temperature records. The Louisiana Total Maximum Daily Load Technical Procedures (LTP) have been followed in this study (Waldon et al. 1998).

The model used for this TMDL was LA-QUAL, a steady-state one-dimensional water quality model. In 1999, the LDEQ and Wiland consulting, Inc. developed LA-QUAL based on QUAL-TX Version 3.4. The program was converted from a DOS-based program to a Windows-based

Table 2. Point Source Waste Load Allocations

Discharger to Bayou Des Cannes									
Facility	Permit #	Receiving Water	Discharge Flow MGD	Summer CBOD5/NH3-N mg/l	Winter CBOD5/NH3-N mg/l	Summer CBOD5 WLA lbs/day	Summer NH3-N WLA lbs/day	Winter CBOD5 WLA lbs/day	Winter NH3-N WLA lbs/day
City of Iota STP		Bayou Des Cannes	0.285	10/10	10/10	23.77	23.77	23.77	23.77
		TOTAL				23.77	23.77	23.77	23.77
		TOTAL (NH3-N * 4.3=UNBOD)					102.21		102.21
		TOTAL (CBOD5 * 2.3=UCBOD)				54.67		54.67	

Note: NH3-N represents total nitrogen.

program with a graphical interface and enhanced graphic output. Other program modifications specific to the needs of Louisiana and the LDEQ were also made. LA_QUAL is a user-oriented model and is intended to provide the basis for evaluating total maximum daily loads in the State of Louisiana. See LDEQ (1999) for a more detailed description.

3.2 Load Allocations

Seasonal load allocations are presented in Table 3. See LDEQ (1999) for a detailed discussion of load allocation. The load allocation in Table 3 is the same as that given in Table 7 (LDEQ 1999) for Headwater/Tributary loads. Load allocations in Table 3 are the sum of load allocations and benthic loads listed in Table 7 of LDEQ (1999).

As presented in LDEQ (1999), the summer season DO criterion of 3.0 mg/L can be maintained with a 50% reduction of all manmade nonpoint sources for reaches 1-6 and a 75% reduction of all manmade nonpoint sources for reaches 7-8. For the winter season, the DO criterion of 5.0 mg/L can be maintained with a 50% reduction from all manmade nonpoint sources for reaches 1-6 and a 75% reduction for reaches 7-8.

Table 3 Total Maximum Daily Loads

ALLOCATION	SUMMER (March - November) lbs/day UBOD=UCBOD+UNBOD	WINTER (December - February) lbs/day UBOD=UCBOD+UNBOD
Point Source WLA	156.88	156.88
Margin of Safety	57.00	57.00
Load Allocation	16351	19901
TMDL	16564.88	20114.88

3.3 Wasteland Allocations

The seasonal wasteload allocation for one point source discharger is presented in Tables 2 and 3.

3.4 Seasonal Variation

Critical conditions for dissolved oxygen in Louisiana have been determined to be when there is negligible nonpoint run-off and low stream flow combined with high stream temperature. In addition, the models account for loadings that occur at higher flows by modeling sediment oxygen demand. Oxygen demanding pollutants that enter the stream during higher flows settle to the bottom and then exert the greatest oxygen demand during the high temperature seasons. Additionally, the 1999 TMDL looked at the winter and summer seasons by varying temperature.

3.5 Margin of Safety

The margin of safety (MOS) presented in Table 3 is the same as that reported in Table 7 of LDEQ (1999). The MOS accounts for any lack of knowledge or uncertainty concerning the relationship between load allocations and water quality. According to LDEQ (1999), the highest temperatures occur in July-August, the lowest stream flows occur in October-November, and the maximum point source discharge occurs following a significant rainfall, i.e. high-flow conditions. The combination of these conditions, in addition to other conservative assumptions regarding rates and loadings, yield an implied MOS which is estimated to be in excess of 10%. Over and above this implied MOS, LDEQ regularly uses an explicit MOS of 20% for both point source loads.

4. Other Relevant Information

Utilizing funds under Section 106 of the federal Clean Water Act and under the authority of the Louisiana Environmental Quality Act, the LDEQ has established a program for monitoring the quality of the state's surface waters. The LDEQ Surveillance Section collects surface water samples at various locations, utilizing appropriate sampling methods and procedures for ensuring the quality of the data collected. The objectives of the surface-water monitoring program are to determine the quality of the state's surface waters, to develop a long-term database for water quality trend analysis, and to monitor the effectiveness of pollution controls. The data obtained through the surface-water monitoring program is used to develop the state's biennial 305(b) report (*Water Quality Inventory*) and the 303(d) list of impaired waters. This information is also utilized in establishing priorities for the LDEQ nonpoint source program.

The LDEQ has implemented a watershed approach to surface water quality monitoring. Through this approach, the entire state is sampled over a five-year cycle with two targeted basins sampled each year. Long-term trend monitoring sites at various locations on the larger rivers and Lake Pontchartrain are sampled throughout the five-year cycle. Sampling is conducted on a monthly basis or more frequently if necessary to yield at least 12 samples per site each year. Sampling sites are located where they are considered to be representative of the waterbody. Under the current monitoring schedule, targeted basins follow the TMDL priorities. In this manner, the first TMDLs will have been established by the time the first priority basins will be monitored again in the second five-year cycle. This will allow the LDEQ to determine whether there has been any improvement in water quality following implementation of the TMDLs. As the monitoring results are evaluated at the end of each year, waterbodies may be added to or removed from the 303(d) list. The sampling schedule for the first five-year cycle is shown below. The Mermentau River Basin will be sampled again in 2003.

1998 – Mermentau and Vermilion-Teche River Basins
1999 - Calcasieu and Ouachita River Basins
2000 – Barataria and Terrebonne Basins
2001 – Lake Pontchartrain Basin and Pearl River Basin
2002 – Red and Sabine River Basins
(Atchafalaya and Mississippi Rivers will be sampled continuously.)

In addition to ambient water quality sampling in the priority basins, the LDEQ has increased compliance monitoring in those basins, following the same schedule. Approximately 1,000 to 1,100 permitted facilities in the priority basins were targeted for inspections. The goal set by LDEQ was to inspect all of those facilities on the list and to sample 1/3 of the minors and 1/3 of the majors. During 1998, 476 compliance evaluation inspections and 165 compliance-sampling inspections were conducted throughout the Mermentau and Vermilion-Teche River Basins.

5. Public Participation

When EPA establishes a TMDL, 40 C.F.R. § 130.7(d)(2) requires EPA to publicly notice and seek comment concerning the TMDL. Pursuant to an October 1, 1999, Court Order, EPA prepared this TMDL. After submission of this TMDL to the Court, EPA commenced preparation of a notice seeking comments, information and data from the general and affected public. Comments and additional information were submitted during the public comment period and this Court Ordered TMDL was revised accordingly. EPA has transmitted this revised TMDL to the Court, and to the Louisiana Department of Environmental Quality (LDEQ) for incorporation into LDEQ's current water quality management plan.

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APPENDIX A

(Source: http://www.deq.state.la.us/surveillance/wqdata/0308wqng.txt)

050101 Bayou Des Cannes northeast of Jennings, LA

Date	NO2+NO3	TKN	TP	TOC	TN	N:P	N:P avg	Time	Depth
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L			m
12/15/98	0.38	0.55	0.24	9.6	0.93	3.88	5.61	1005	1.0
11/23/98	0.14	1.00	0.20	11.3	1.14	5.70		955	1.0
11/9/98	1.11	1.10	0.17	7.2	2.21	13.00		1012	1.0
10/28/98	0.40	1.09	0.17	9.6	1.49	8.76		1018	1.0
10/13/98	0.16	1.15	0.20	8.9	1.31	6.55		1020	1.0
9/22/98	0.02	0.83	0.24		0.85	3.54		1004	1.0
9/8/98	0.21	0.87	0.17		1.08	6.35		1023	1.0
8/25/98	0.44	1.37	0.22		1.81	8.23		1020	1.0
8/11/98	0.20	0.83	0.20		1.03	5.15		959	1.0
7/28/98	0.46	0.61	0.32		1.07	3.34		1020	1.0
7/14/98	0.25	1.03	0.23		1.28	5.57		952	1.0
6/23/98	0.10	1.57	0.24		1.67	6.96		1010	1.0
5/11/98	0.55	1.40	0.38	10.4	1.95	5.13		1028	1.0
3/9/98	0.24	1.32	0.26	11.6	1.56	6.00		950	1.0
1/12/98	0.04	0.93	0.21	6.8	0.97	4.62		1020	1.0
11/18/97	0.41	1.04	0.16	7.9	1.45	9.06		1046	1.0
9/8/97	0.65	0.95	0.24	7.0	1.60	6.67		1035	1.0
7/14/97	0.25	0.85	0.18	10.3	1.10	6.11		1010	1.0
5/12/97	0.59	2.36	0.58	9.7	2.95	5.09		1040	1.0
3/10/97	0.23	1.50	0.27	13.4	1.73	6.41		950	1.0
1/7/97	0.14	1.24	0.27	13.7	1.38	5.11		1010	1.0
11/18/96	0.11	1.15	0.21	7.3	1.26	6.00		1040	1.0
9/9/96	0.16	1.61	0.36	11.9	1.77	4.92		1033	1.0
7/9/96	0.47	1.31	0.27	14.6	1.78	6.59		1012	1.0
5/13/96	0.90	1.50	0.31	18.0	2.40	7.74		1006	1.0
3/11/96	0.58	0.58	0.23	10.5	1.16	5.04		940	1.0
1/8/96	0.37	0.11	0.20	10.0	0.48	2.40		930	1.0
11/13/95	0.11	0.62	0.28	9.7	0.73	2.61		930	1.0
9/12/95	0.10	1.09	0.21	10.9	1.19	5.67		1045	1.0
7/11/95	0.30	0.78	0.20	6.1	1.08	5.40		1100	1.0
5/9/95	0.61	1.25	0.42	8.9	1.86	4.43		1040	1.0
3/14/95	0.12	1.52	0.22	12.2	1.64	7.45		1043	1.0
1/10/95	0.58	1.70	0.43	9.0	2.28	5.30		1040	1.0
11/15/94	0.44	0.96	0.24	8.4	1.40	5.83		1000	1.0

Date	NO2+NO3	TKN	TP	TOC	TN	N:P	N:P avg	Time	Depth
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L			m
9/13/94	0.20	0.98	0.24	8.3	1.18	4.92		1015	1.0
7/12/94	0.30	1.16	0.24	7.3	1.46	6.08		945	1.0
5/11/94	0.57	1.39	0.33	8.8	1.96	5.94		1040	1.0
3/15/94	0.21	1.25	0.29	10.5	1.46	5.03		1040	1.0
1/11/94	0.36	1.54	0.30	8.2	1.90	6.33		1040	1.0
11/16/93	0.13	1.19	0.25	15.6	1.32	5.28		1010	1.0
9/14/93	0.02	1.13	0.17	8.9	1.15	6.76		1045	1.0
7/13/93	0.45	1.11	0.25	11.3	1.56	6.24		1110	1.0
5/11/93	0.40	1.12	0.26	12.0	1.52	5.85		1045	1.0
3/9/93	0.17	0.87	0.21	10.4	1.04	4.95		1045	1.0
1/12/93	0.11	0.88	0.24	9.2	0.99	4.13		1110	1.0
11/17/92	0.24	1.11	0.28	14.2	1.35	4.82		1100	1.0
9/15/92	0.17	0.98	0.33	10.6	1.15	3.48		955	1.0
7/14/92	0.35	0.85	0.24	8.4	1.20	5.00		1100	1.0
5/11/92	1.08	1.72	0.37	12.7	2.80	7.57		1015	1.0
3/10/92	0.17	0.58	0.21	8.0	0.75	3.57		1015	1.0
1/7/92	0.61	1.05	0.29	8.4	1.66	5.72		1015	1.0
11/19/91	0.56	0.88	0.34	9.9	1.44	4.24		1030	1.0
9/10/91	0.32	0.92	0.28	9.3	1.24	4.43		1015	1.0
7/16/91	0.26	1.12	0.31	7.2	1.38	4.45		1030	1.0
5/14/91	0.39	0.87	0.24	8.7	1.26	5.25		932	1.0
3/12/91	0.46	1.28	0.36	13.1	1.74	4.83		1045	1.0
1/15/91	0.10	0.67	0.19	7.8	0.77	4.05		1000	1.0